IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR UNITED STATES LETTERS PATENT

INVENTOR: Joseph K. DODD

TITLE: HOSE-END ASPIRATION-TYPE SPRAYER

BACKGROUND OF THE INVENTION

This invention relates generally to an aspiration-type dispenser adapted to be connected to a source of pressurized carrier liquid, such as a garden hose, and further adapted to be coupled to a container of chemical liquid to be diluted upon aspiration.

Aspiration-type dispensers of the general type aforedescribed are known, for example, from patents 5,383,603, 5,320,288 and 5,100,059. In each of these patents a cylindrical valve is disclosed for controlling the flow of the carrier liquid except that aspiration takes place generally downstream thereof thereby requiring an elongated and more complex structure which includes additional ducting and passageways. Also, parts and details required for these known sprayers add to the cost of manufacturing and assembly, which is undesirable. Moreover, the known aspiration-type sprayers are not user friendly and have limited features which have stimulated the need for many improvements.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a sprayer assembly for connection to a container of a liquid chemical to be diluted upon aspiration by a pressurized stream of carrier liquid, which has a minimum number of parts, is compact and economical yet highly efficient in aspirating the chemical liquid in a most convenient

and user friendly manner.

Another object of this invention is to provide such an assembly which comprises a housing having a carrier liquid and chemical liquid inlet passages and a discharge passage. A rotatable valve located within the housing has a carrier liquid duct and an intersecting chemical liquid duct interconnecting the inlet passages in a first rotative position of the valve, and the inlet passage is closed by the valve in a second rotative position thereof.

Further object of the present invention is to provide such an assembly wherein the housing has couplings for connection to a source of the carrier liquid and to a container of the liquid chemical, the housing having an integral handle to be grasped by the user for holding the sprayer assembly when spraying, the handle extending outwardly from an upper wall of the housing and having a gripper bar for hand holding.

Another object is to provide such an assembly wherein a diverter is mounted downstream of the discharge end of the housing, the diverter having a wall sloping in one direction lying along the path of the discharge passage for deflecting the liquid flow from the discharge passage to effect a flat spray pattern in that one direction.

Another object is to provide an assembly with such a diverter in the form of a rotatable nozzle having a pair of spaced sloping walls lying in the path of the discharge

3

passage upon nozzle rotation for selectively deflecting the liquid flow in one or another direction.

A still further object of this invention is to provide such a sprayer assembly wherein the housing has a support sleeve coaxial with its chemical inlet opening, a dip tube retainer being coupled to such sleeve, the retainer having a cylindrical wall for suspending the dip tube extending into the chemical container, and the retainer having a transverse wall with an inlet orifice coaxial with the chemical inlet opening, the orifice being of a predetermined size to effect a given chemical liquid-to-carrier liquid ratio.

Another object of the invention is to provide such an assembly wherein carrier liquid inlet and chemical liquid inlet passages extend into a cylindrical bore of the housing and the discharge passage extends from the bore which extends transversely to the passages, the cylindrical valve is rotatable within the bore about its central axis thereof between on and off positions, the valve having annular seal rings at opposite ends in engagement with the bore, and the entirety of the valve being of an injection molded polymeric material wherein the seal rings are of more softer and more compliant material compared to that of the valve material.

A still further object of this invention is to provide such an assembly wherein the coupler for connecting the housing to the liquid carrier source includes an anti-siphon

means which permits only one-way flow of carrier liquid in a downstream direction of the housing via through the carrier liquid inlet passage.

Other objects, advantages and novel features of the invention will become more apparently from the following detailed description of the invention when taken into conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side elevational view of a sprayer assembly according to the invention shown coupled to the end of a hose;

Fig. 2 is a view similar to Fig. 1 showing a structural detail end section, the valve shown in an open position with the spray diverted upwardly;

Fig. 3 is a view similar to Fig. 2, the valve shown in its on position with the spray diverted downwardly;

Fig. 4 is a view similar to Fig. 2, the valve shown in its on position with the spray being undiverted;

Fig. 4A is a cross-sectional view taken substantially along the line 4-4 of Fig. 4;

Fig. 5 is a view similar to Fig. 2 showing the valve in a rotative position with the water carrier inlet open and the chemical inlet closed in a rinse position;

Fig. 6 is a view similar to Fig. 2 with the valve rotated to its off position;

Fig. 7 is an expanded perspective view of an anti-siphon assembly of the invention at the carrier inlet coupler end which is shown assembled together in Figs. 2 to 6;

Fig. 8 is an enlarged perspective view of the cylindrical valve according to the invention in one rotative position;

Fig. 9 is a view similar to Fig. 8 of the valve shown in another rotative position;

Fig. 10 is a perspective view of the dip tube retainer of the invention; and

Fig. 11 is a perspective view of the diverter nozzle of the invention shown in Figs. 2 to 6.

DETAILED DESCRIPTION OF THE INVENTION

Turning now to the drawings wherein like reference characters refer to like and corresponding parts throughout the several views, the sprayer assembly according to the invention is generally designated 20, the assembly having a housing 21 coupled to both container C (Fig. 2) of liquid chemical, and coupled to a source of pressurized carrier liquid such as via the end of a garden hose 22 which extends from a standard water faucet (not shown).

Applied to one side of the housing indicia is ON, OFF, or RINSE to identify the three positions of the sprayer to be described in more detail hereinafter.

As more clearly shown in Fig. 2, the housing has a carrier liquid inlet passage 23 and a chemical liquid inlet passage or opening 24 lying along perpendicular axes and extending into a transverse bore 25 of the housing. A discharge passage 26 extends from the transverse bore of the housing and may be coaxial with or parallel and offset to carrier liquid inlet passage 23.

Rotatably mounted within the bore is a cylindrical valve 27 shown in perspective in Figs. 8 and 9. The valve has a cylindrical outer wall 28 and may be closed at one end by an end wall 29. A pair of spring legs 31, extending outwardly of wall 29, are adapted to extend through a central opening of a confronting wall 33 of the housing (Fig. 9), the legs having barbs 32 snapping behind an edge of the central opening to retain the cylindrical valve in place within the housing.

The valve has, as more clearly shown in Figs. 2 to 6, a carrier liquid inlet duct 34 extending along the diameter of the cylindrical valve, and a radially extending chemical liquid duct 35 in open communication with duct 34. And the cylindrical valve has a turning tab 36 or the like (Figs. 8, 9) to be grasped by the operator for rotating the valve about its central axis, and an indicator bar 37 or the like extending outwardly of its

external wall 28. Extending through wall 28 of the valve is a vent port 38 which, in one of the open positions of Fig. 2, is in alignment with a corresponding vent port 39 provided in the housing.

A dip tube 41 is coupled to the housing and extends into the liquid of container C to be aspirated.

The cylindrical valve is shown in Figs. 1, 2 and 3 in its ON position in that it has been rotated manually into that position as confirmed by indicator 37 lying adjacent the ON marking on the housing. In that position a detent 42 (Fig. 1) may be provided on the housing for arresting further counterclockwise rotation of the cylindrical valve from that shown in Figs. 1 to 3.

In the ON position, as clearly shown in Fig. 2, the carrier liquid, i.e., water under pressure from the open garden hose, passes through inlet passage 23 and as the liquid stream passes over the inner opening of duct 35 the chemical product is aspirated or drawn from the container up the dip tube and into the carrier liquid stream so as to be thereby diluted as the water and chemical mix is discharged through the assembly via discharge passage 26.

Referring to Fig. 6, valve 27 is shown rotated clockwise until the indicator bar stops at position 37B shown in Fig. 1, at which it abuts against a stop element 43 on the

housing in an OFF position. Ducts 34, 35 are thus rotated completely out of alignment with the passages in the housing such that an elastomeric section 44 on the outer periphery of the cylindrical valve (Fig. 8) to be described in more detail hereinafter, overlies carrier liquid inlet passage 23 for sealing the same tightly closed. Also in the Fig. 6 position, an external seal portion 45 (Fig. 9) on the periphery of valve 27 seals tightly over chemical liquid inlet passage 24.

Referring now to Fig. 5, the outer surface of cylindrical wall 28 of the valve is notched as to provide a depression 48 which opens into upstream end 46 of duct 34 (see also Fig. 8). Similarly, the outer surface of cylindrical wall 28 of the valve is notched to form a depression 49 (Fig. 9) which communicates with downstream end 47 of duct 34 when the valve is rotated into its Fig. 5 position as confirmed by the position 37A of indicator bar 37 shown in Fig. 1. The assembly has been rotated into its RINSE position as indicated by the indicia R in Fig. 1. In such position, seal portion 45 on the outer periphery of the valve overlies chemical liquid inlet passage 24 in tight sealing relationship for sealing it closed. However, duct 34 is in open communication with carrier liquid inlet passage 23 and with discharge passage 26 via their respective depressions 48 and 49. The assembly may therefore be rinsed for cleansing the assembly prior to attaching a container of another chemical to this assembly if desired.

Moreover, the operator can in the rinse R position simply spray or apply a stream of liquid to the plants or grass in the garden without the need to uncouple the assembly from the hose end.

In accordance with another feature of the invention, the sprayer assembly can be conveniently, comfortably and securely held by the hand of the operator during use by the provision of a handle 51 integrally formed with housing 21 and extending upwardly from an upper wall thereof. The handle has a gripper bar 52 which may be contoured on its underside to provide a finger rest indentation 53 and a contour 54 along its lower edge. The gripper bar extends in an upstream direction substantially parallel to the longitudinal axis of housing 21.

Yet another feature of the invention is the provision of a diverter for deflecting the stream of liquid from the discharge passage in the form of a flat spray dispersed over a wide area. A rotatable nozzle 55 is mounted at the downstream end of the housing, as shown in Figs. 1 to 6 and in more detail in Fig. 11. The nozzle has a pair of spaced apart deflector plates 56, 57, and the nozzle when mounted in place has its central axis offset from the axis of discharge passage 26.

In the manually rotated position of the nozzle shown in Figs. 2 and 11, deflector plate 56 is positioned such that its inner surface 58 is in the path of the liquid flow

through the discharge passage such that the liquid is thereby deflected in an upward direction.

On rotation of the nozzle through 180° shown in Fig. 3, deflector plate 57 is positioned such that its outer surface 59 lies in the path of the flow of liquid through the discharge passage, thereby diverting the flow in a downward direction as shown. In the Fig. 3 position, the valve 27 is in the same rotative ON position as in Fig. 2.

In each of the diverted spray up or spray down positions of Figs. 2 and 3, the stream of liquid flowing through the discharge passage forms flat sprays over a wide area. To enhance the dispersion and to create a spray of bubbles surfaces 58 and 59 may be roughened as shown in some known manner.

In the Fig. 4 position with the valve likewise in an ON position, rotatable nozzle 55 is rotated such that neither of surfaces 58 or 59 of the deflector plates is in the path of the flow of liquid through discharge passage 26. The liquid flow is thus not deflected but instead emerges as a stream as shown.

Likewise in the RINSE position of Fig. 5, nozzle 55 is shown rotated to the same position as in Fig. 4 in which neither of surfaces 58 or 59 of the deflector plates is in the path of the discharge passage. Thus in the RINSE position the flow of liquid emerges as a stream from the discharge passage.

It can be seen that in the ON positions of Figs. 2, 3 and 4, vent ports 38 and 39 are aligned for venting the interior of the container to atmosphere via the open end of the cylindrical valve as shown in Fig. 4A. However, in the RINSE position of Fig. 5 and in the OFF position of Fig. 6, vent port 38 in the valve and vent port 39 in the housing are misaligned to thereby close the vent path to avoid leakage of chemical from the container in the OFF position if the assembly is placed on its side.

When spraying chemicals in the lawn or garden, such as pesticides and the like, the concern arises that chemical could be drawn into the water supply which is not only undesirable but potentially hazardous. To avoid this potential problem an anti-siphon assembly generally designated 61 in Fig. 7 has been devised. Referring to Figs. 2 to 6, housing 21 is coupled to hose end 22 (Fig. 1) by the provision of the standard internally threaded coupler 62 having an inwardly directed flange 63 in engagement with an external snap bead 64 at the distal end of conduit 65 which together with the inlet port leading into the bore 25 of the housing, defines the carrier liquid inlet passage. Assembly 61 includes a valve disc 66, which may be of elastomeric material, the disc having a central cruciform opening 67 which defines a one-way valve therethrough. The assembly further comprises a flow regulator 68 having a plurality of carrier liquid inlet openings 69 in a circular array, the diameter of the circle exceeding the size of the

opening 67 such that the opening abuts against an imperforate inner portion 71 of the regulator. A standard hose washer 72 is located upstream of the flow regulator, and a cylindrical seal 73 is mounted within conduit 65 on the downstream side of valve disc 66. Seal 73 is resilient and has a seal ring 74 in sealing engagement with valve disc at a diametral location outwardly of openings 69.

Cylindrical seal 73 at its upstream face has a plurality of notches 75 opening into cutout sections 76 located in the outer surface of the cylindrical seal.

In operation, the carrier liquid through hose 22 inlets openings 69, expanding the central portion of disc valve 66 permitting downstream flow through inner sleeve 77 of seal 73. Any flow in an upstream direction is blocked as the central valve area of disc 66 seats tightly against imperforate center section 71 of flow regulator 68. Also upon creation of any back pressure the same is relieved through notches 75 of cylindrical seal 73 and escapes in a downstream direction via cutouts 76 and through hole 80 in the housing 21 (see Fig. 3).

Housing 21 is likewise coupled to liquid chemical container C via a standard internally threaded coupling 78 as an inner flange thereof engages a groove in end collar 79 of the housing. Disc seal 81 is disposed between collar 79 and the upper end of the container neck. The seal may have a non-circular central opening, such as

rectangular, surrounding sleeve 82 which depends from housing 21 in coaxial alignment with liquid inlet passage 24. The non-circular opening in disc seal 81 thereby defines a plurality of openings establishing communication between vent ports 38, 39 and the interior of the container.

It is desirable to provide, unlike that found in the prior art, for a variety of chemical/water ratios depending on the garden/lawn conditions to be treated. A higher chemical-to-water ratio may be more desirable for treatment during different times of the year compared to a lower chemical-to-water ratio. Such a mix is made possible by the invention by the provision of a dip tube retainer 83 shown in each of the drawing Figs. 2 to 6 and in more detail in Fig. 10. The dip tube retainer is in the form of an elongated cylinder 84 telescoped within sleeve 82, and has a spaced outer sleeve 85 at the lower end of the cylinder which defines an annular groove in which the lower end of sleeve 82 is received for snugly and tightly securing the tube retainer to sleeve 82 of the housing.

~~Cylinder 84 of the tube retainer has an upper end wall 86 containing an inlet port~~ 87 coaxial with inlet passage 39. Thus in an open ~~position of the~~ valve the chemical is aspirated up the dip tube ~~and into~~ the liquid carrier stream via inlet ports 87 and 24 and ~~duct 35. A given chemical-to-water ratio can be determined by the size of inlet port 87~~

in the inner wall of the dip tube retainer. For a smaller chemical/water ratio a dip tube retainer having a smaller diameter inlet port 87 will be made available giving instruction to the user to simply replace one for the other. Of course should a larger chemical/ water ratio is desired, a dip tube retainer having a larger diameter inlet port 87 will be made available to the user with instructions to replace that tube retainer.

Valve 27 is co-injection molded whereby a first material of relatively hard plastic forms the basic valve which includes its cylindrical outer wall, closed end wall, spring legs 31, turning tab 36 and indicator bar 37. Annular seal rings 88, 89 are formed adjacent opposite ends of cylindrical outer wall 28 of the valve for sealing engagement with the confronting wall of bore 25 of the housing. And, seal portions 44 and 45 of the outer periphery of the valve wall, together with seal rings 88 and 89 are formed of a slightly softer plastic material compared to that of the end portion of the valve during the co-injection process. Channels 91 and 92 are formed in the outer periphery of the valve cylindrical wall for connecting seals 88, 89, seal portion 44 and seal portion 45 together. Thus during the co-injection process, the seals and connecting channels are formed of soft-plastic material utilizing a known co-injection process for this purpose. This avoids the time consuming and relatively more costly process of formulating cylindrical valves such as this with end seals and the like requiring use of a different

material utilizing a separate process and requiring a sub-assembly process.

From the foregoing, it can be seen that a hose end trigger sprayer has been devised with a variety of distinctive features which simplify the operation, molding and assembly rendering the assembly according to the invention economical and easy to use yet highly efficient for outdoor garden and yard spray. The sprayer housing is easily handled by the operator by simply grasping the single handle bar thereby avoiding contact with the chemical/liquid mix being discharged. The manually rotatable nozzle diverts the spray forming a flat spray pattern upwardly or downwardly without the need for changing the attitude of the end held assembly. The nozzle likewise facilitates a rinsing of the control valve which permits a stream discharge with no flat pattern.

The replaceable dip tube retainer facilitates changing the chemical/water mix depending on the needs of the user. And the anti-siphon assembly provides for a unique and simple solution to prevent flow of chemical into the water system and to avoid the creation of any back pressure problems during operation. Moreover the cylindrical valve may be produced by co-injection of different materials, one of which is softer for providing integral seal rings adjacent opposing ends of the valve.

Obviously, many modifications and variations of the present invention are made possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.